

Shifting spatial and temporal marine mammal distributions in the Pacific Arctic

Kate Stafford



Oregon State University

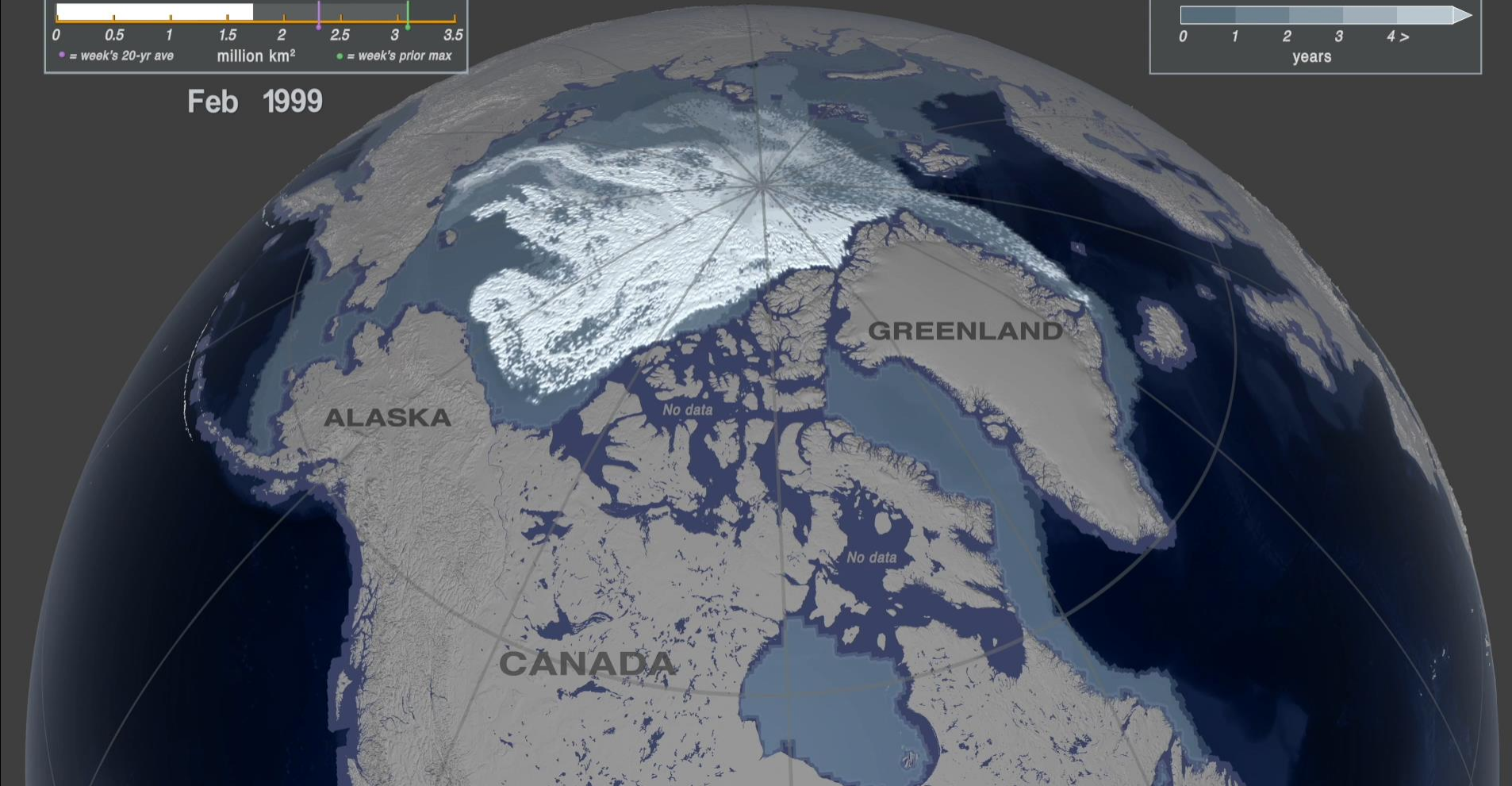
**Marine Mammal
Institute**



Animation from NASA's Scientific Visualization Studio; EASE-Grid Sea Ice Age

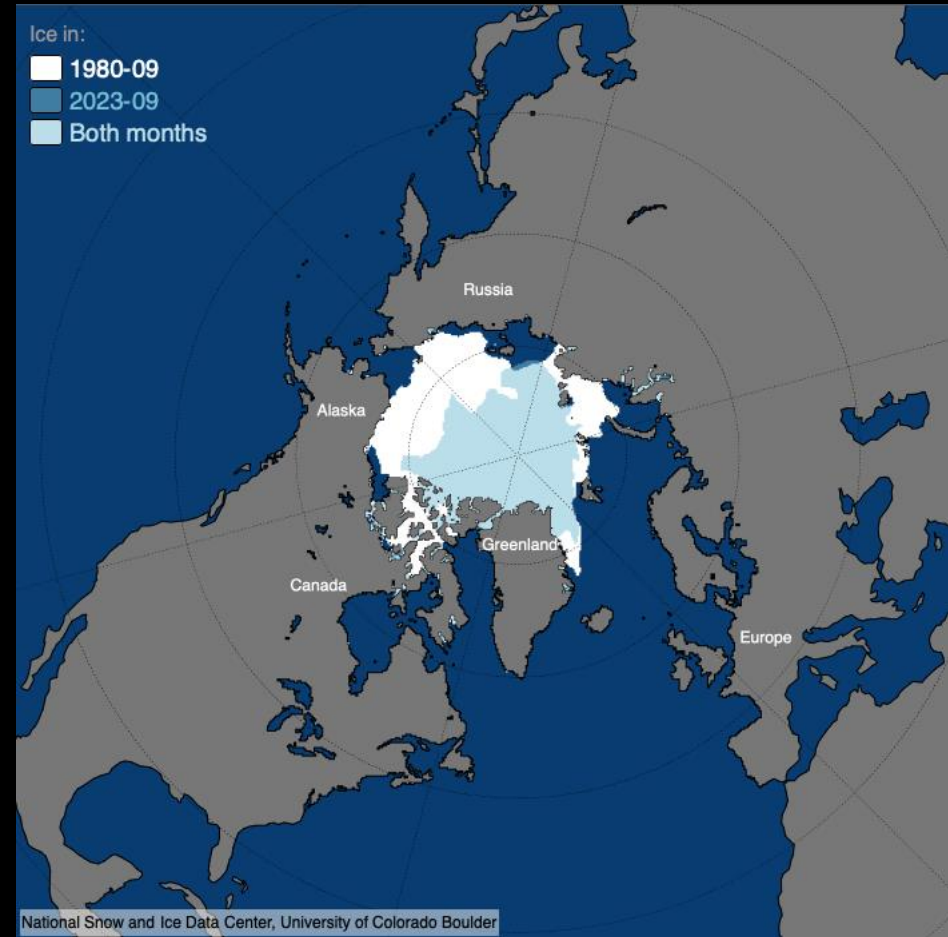
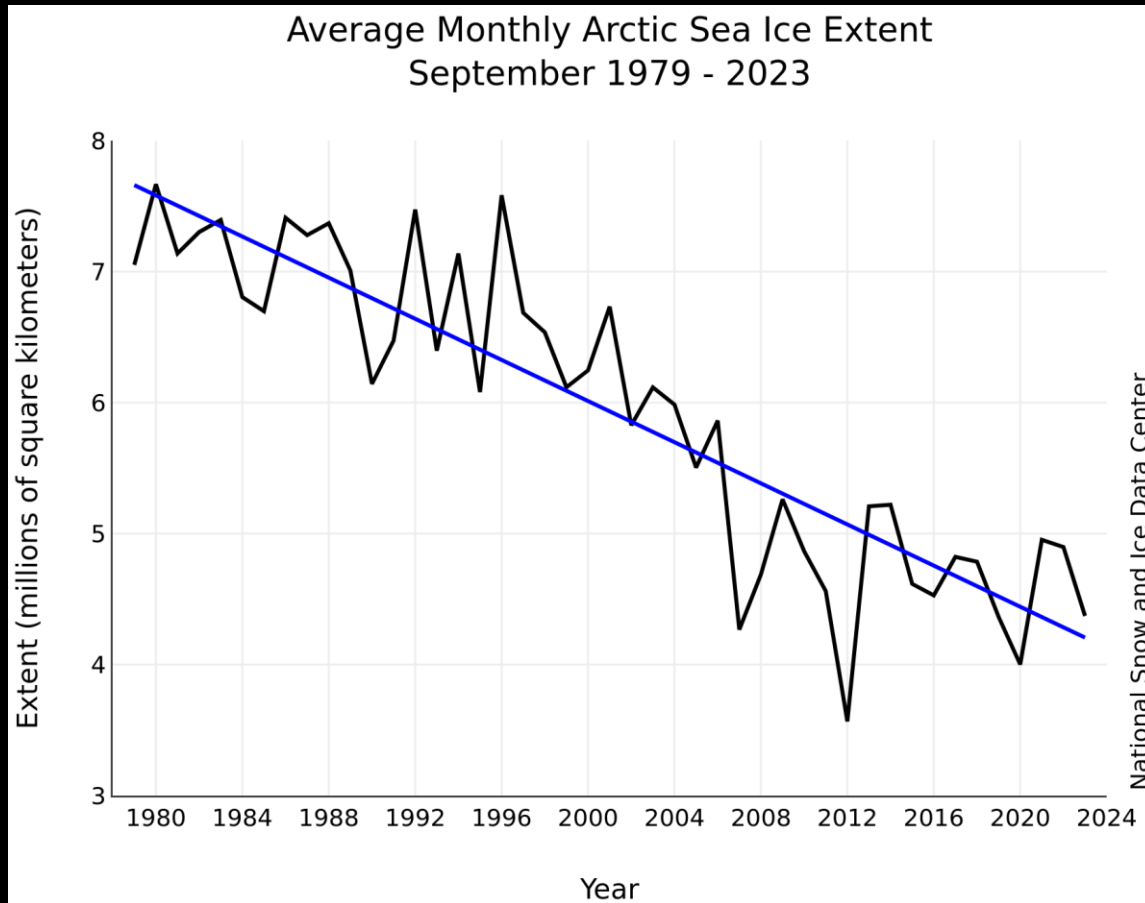


Feb 1999



The ecosystem is changing

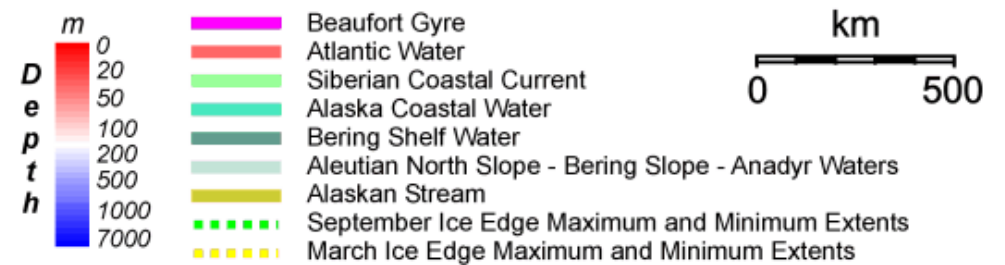
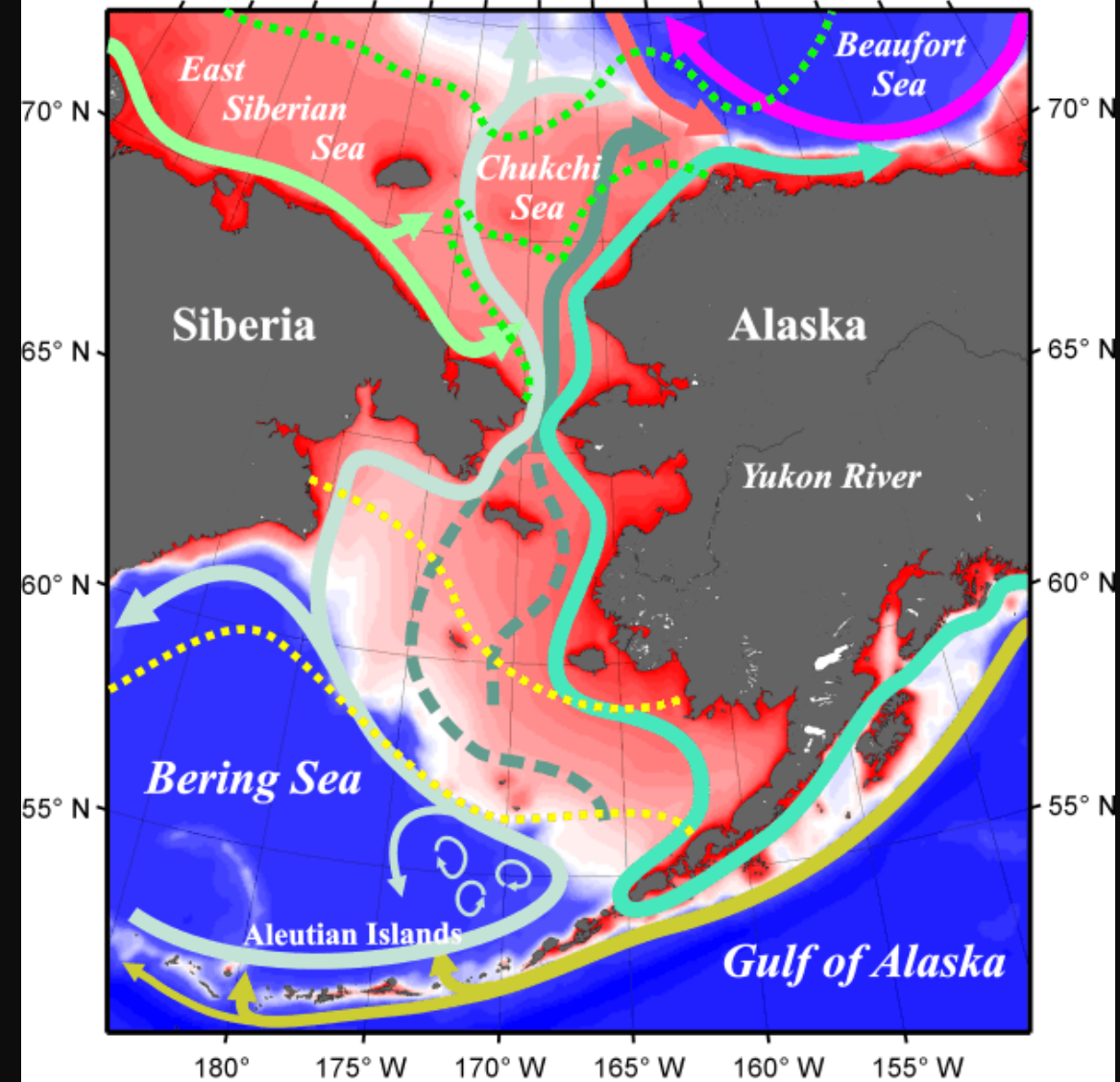
September sea ice extent has decreased 12.2% per decade



Bering Strait

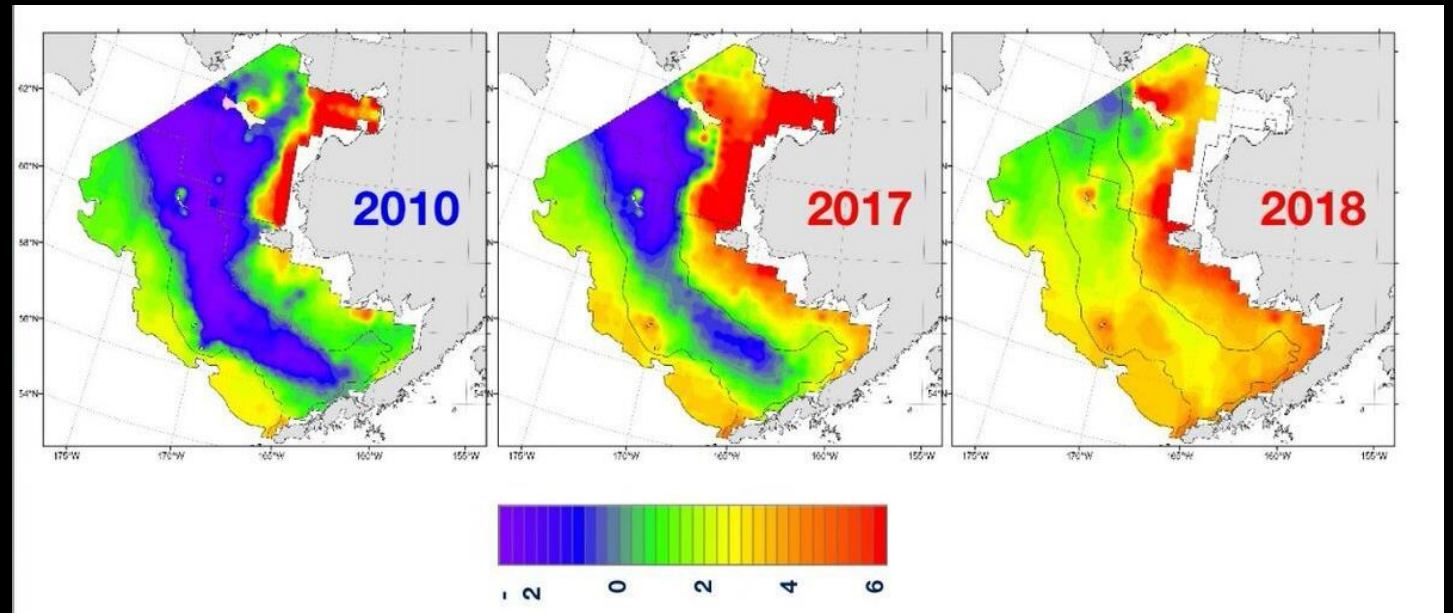
- Only gateway from Pacific to Arctic
- Mass 2x year migration of Arctic marine mammals
- Increased fresh water and heat flowing north
- Decreasing sea ice
- Disappearance of N Bering Sea cold pool

➔ Shifting distributions, changes in prey, and increasing threat exposure



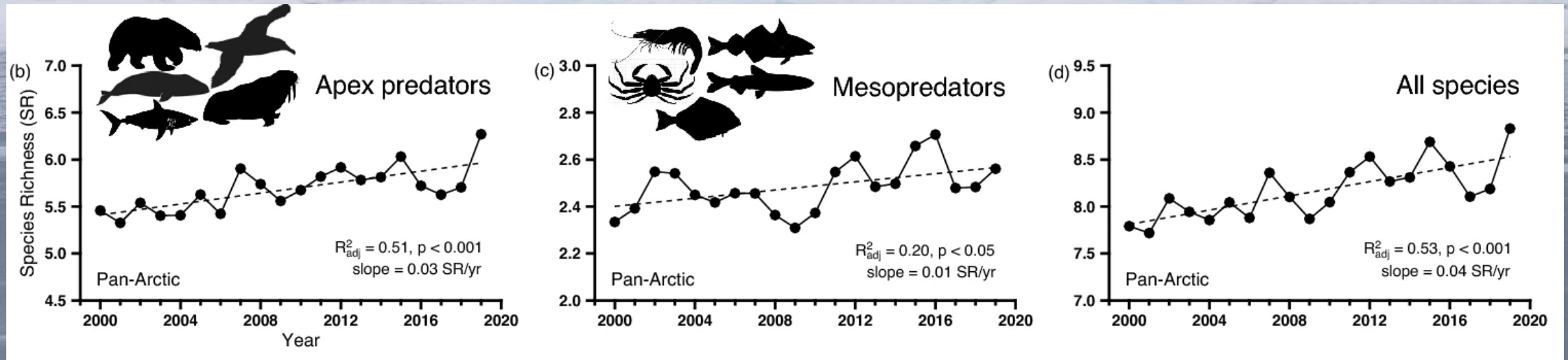
Bering Sea cold pool

- Primarily determined by sea ice extent
 - Structures SE Bering Sea ecosystem but can cascade changes northwards
- 30 m layer of cold bottom water ($\leq 2^{\circ}\text{C}$)
- Creates a boundary between Arctic and subarctic fish species
- Disappeared from 2018-2021 and likely drove changes in fish distribution



NOAA/RACE

Marine Biodiversity is increasing at all trophic levels throughout the Arctic, driven by polewards range shifts

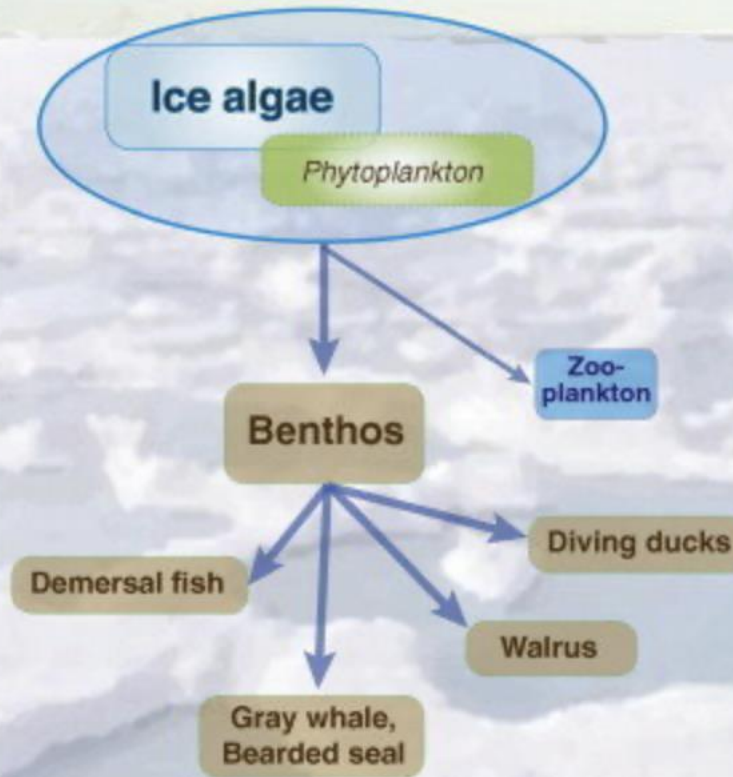


scientific reports

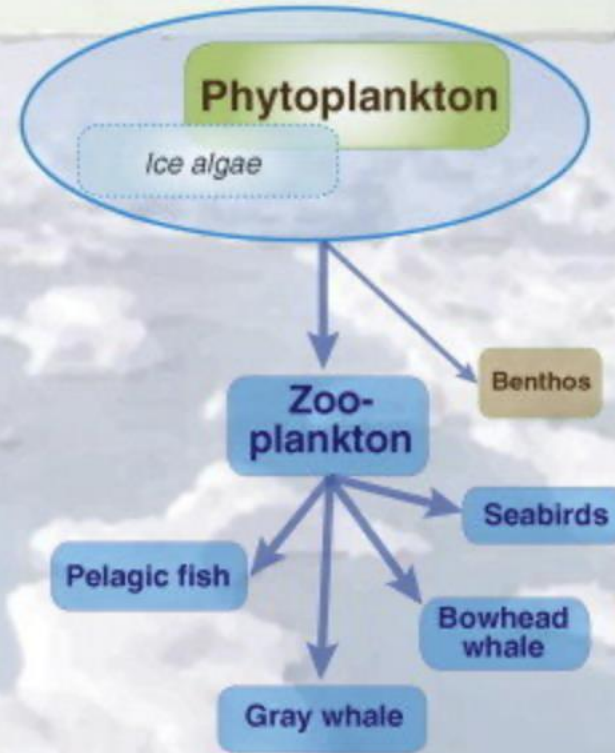
OPEN **Pan-Arctic marine biodiversity and species co-occurrence patterns under recent climate**

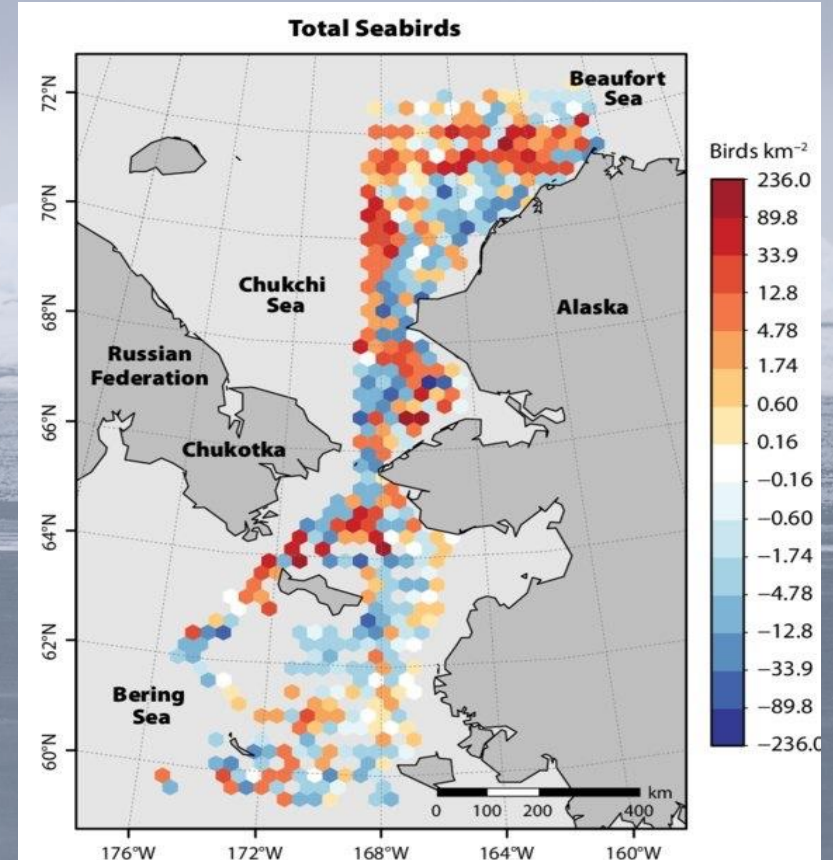
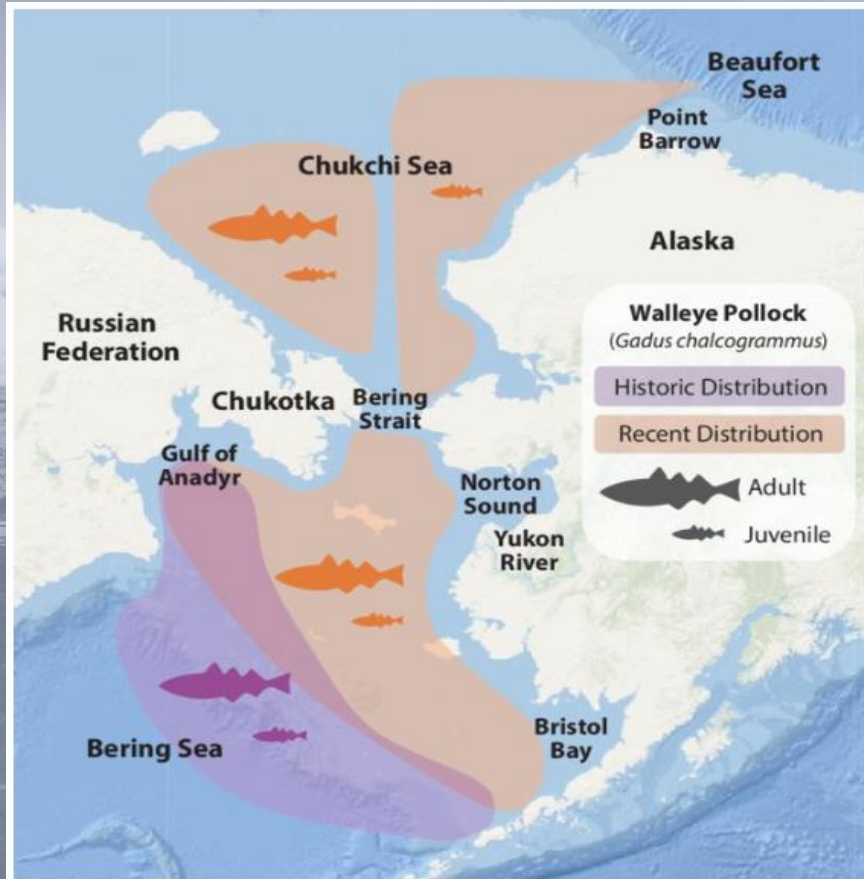
Irene D. Alabía^{1,2}, Jorge García Molinos¹, Takafumi Hirata¹, Franz J. Mueter² & Carmen L. David¹

Benthic Dominated *Past*



Pelagic Dominated *Future*





Oceanography THE OFFICIAL MAGAZINE OF THE OCEANOGRAPHY SOCIETY

HOME ABOUT VIEW ISSUES SUBSCRIBE ORDER ISSUES AUTHOR GUIDELINES

OPEN ACCESS
Northward Range Expansion of Subarctic Upper Trophic Level Animals into the Pacific Arctic Region
By Kathleen M. Stafford, Edward V. Farley, Megan Ferguson, Kathy J. Kuletz, and Robert Levine

Contents lists available at ScienceDirect

ELSEVIER

Deep-Sea Research Part II

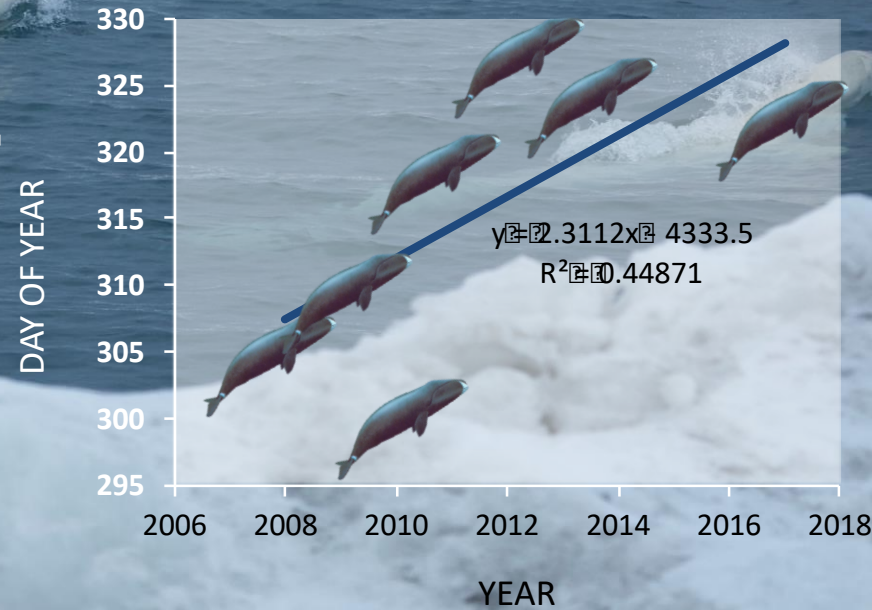
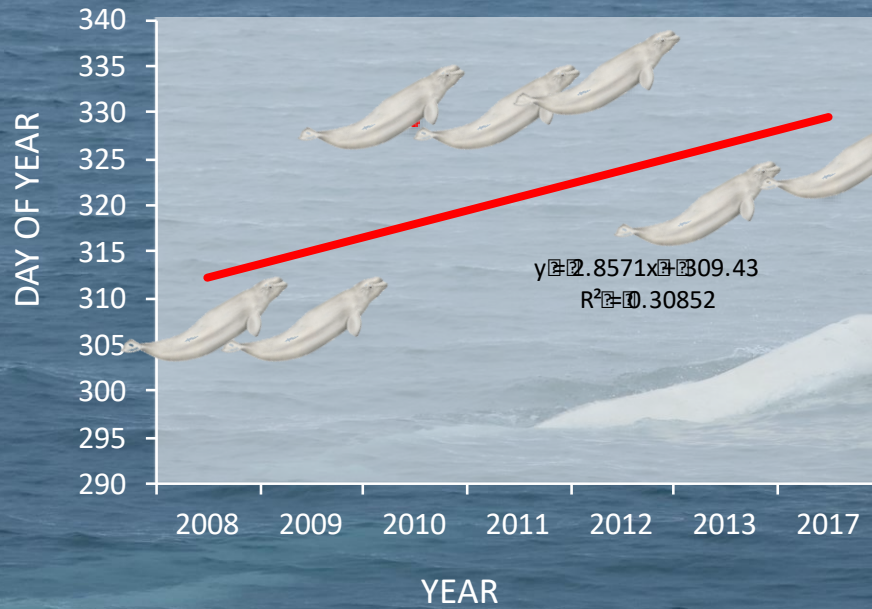
journal homepage: <http://www.elsevier.com/locate/dsr2>

Distributional shifts among seabird communities of the Northern Bering and Chukchi seas in response to ocean warming during 2017–2019

Kathy Kuletz^{a,*}, Daniel Cushing^b, Elizabeth Labunski^b

^a U.S. Fish and Wildlife Service, 1011 E. Tudor Rd, Anchorage, AK, USA
^b Pale Star Ecological Research LLC, Anchorage, AK, USA

Arctic whales migrate south later



PLOS ONE

OPEN ACCESS PEER-REVIEWED

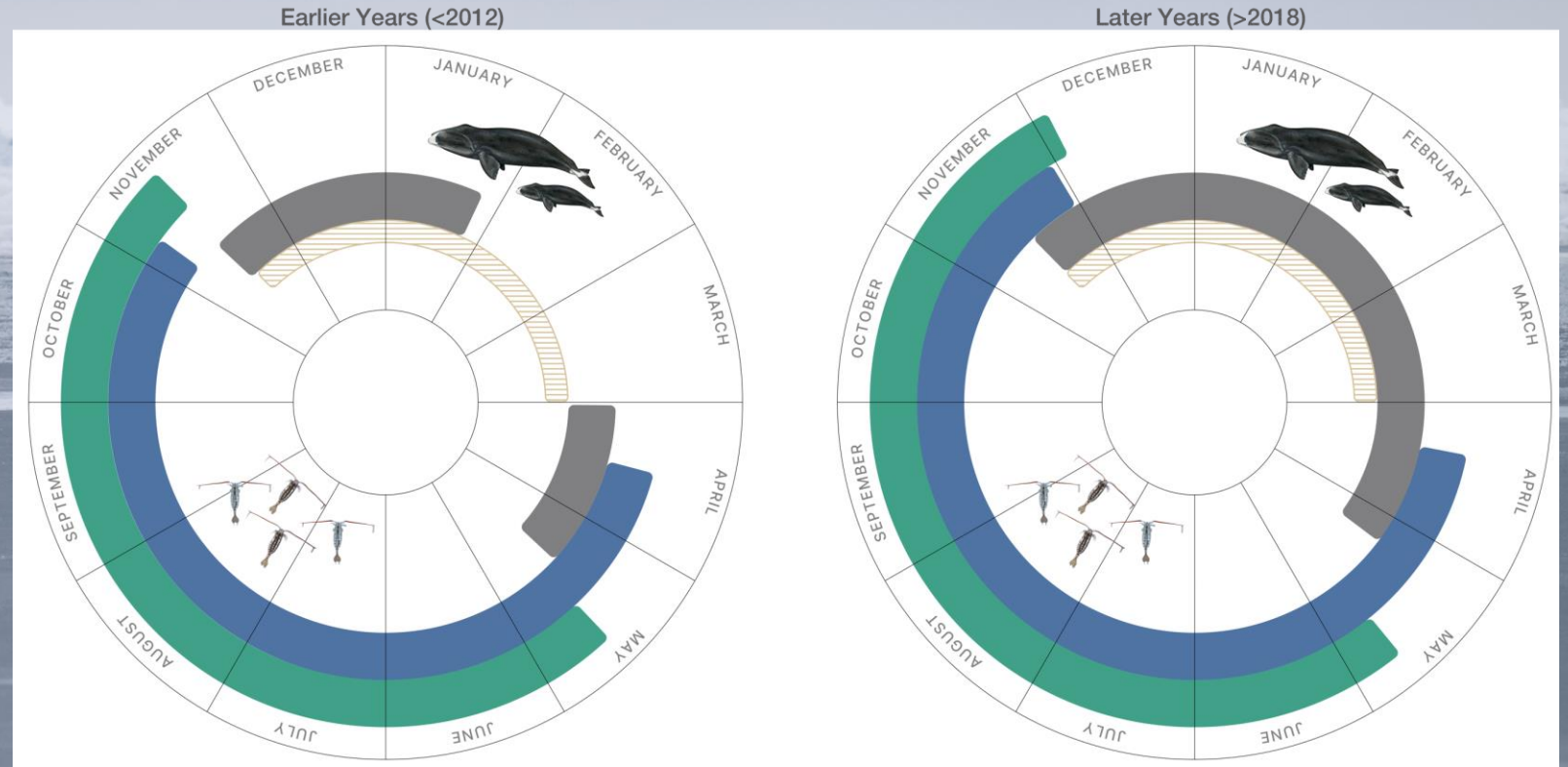
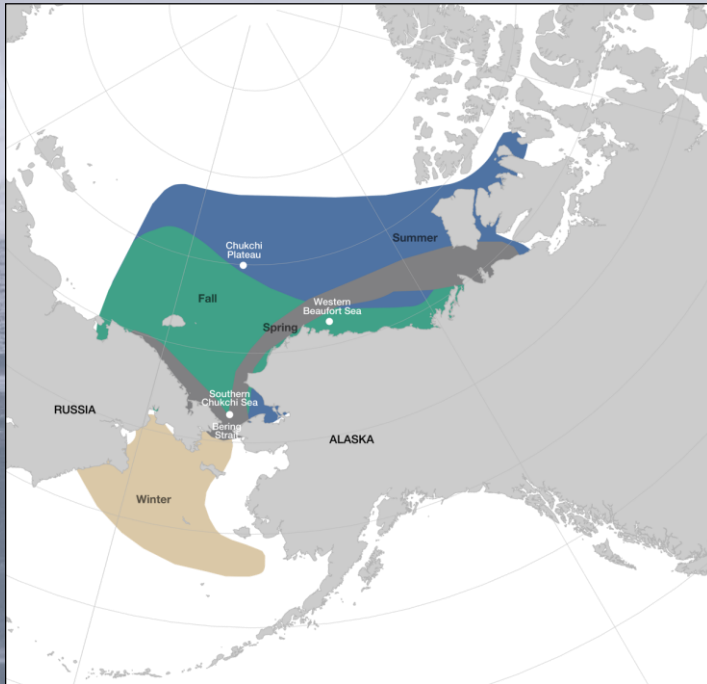
RESEARCH ARTICLE

Bowhead and beluga whale acoustic detections in the western Beaufort Sea 2008–2018

Kathleen M. Stafford, John J. Citta, Stephen R. Okkonen, Jinlun Zhang

Published: June 28, 2021 • <https://doi.org/10.1371/journal.pone.0253929>

Bowhead whale distribution changing



Szesciorka and Stafford *Movement Ecology* (2023) 11:8
<https://doi.org/10.1186/s40462-023-00374-5>

Movement Ecology

RESEARCH

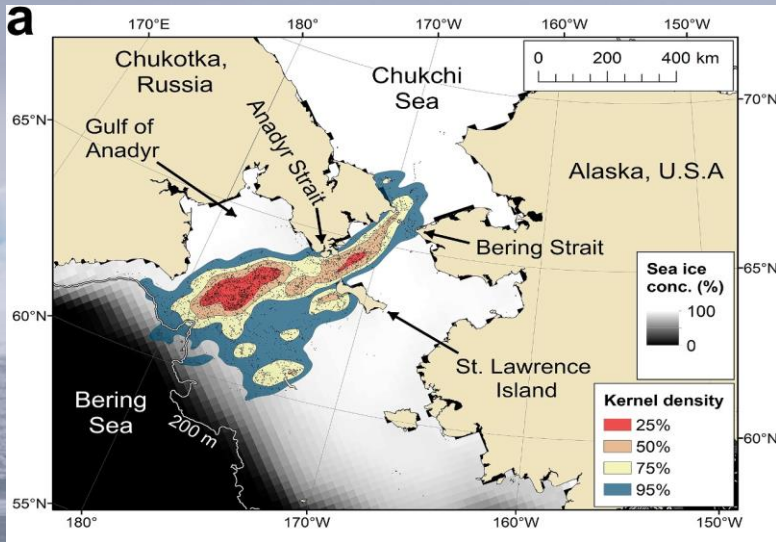
Open Access

Sea ice directs changes in bowhead whale phenology through the Bering Strait

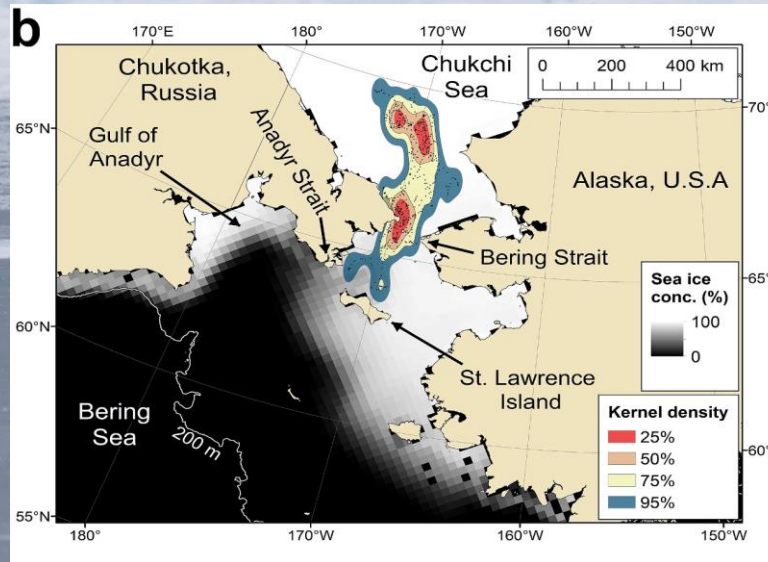
Angela R. Szesciorka and Kathleen M. Stafford

Szesciorka et al. *in review*

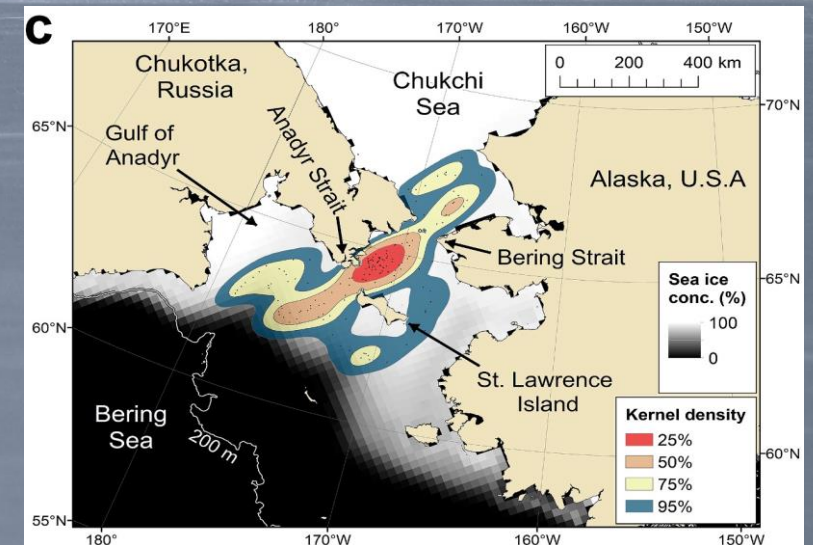
2009-2016 (n=27)



2018 (n=3)



2019 (n=4)



Continental Shelf Research

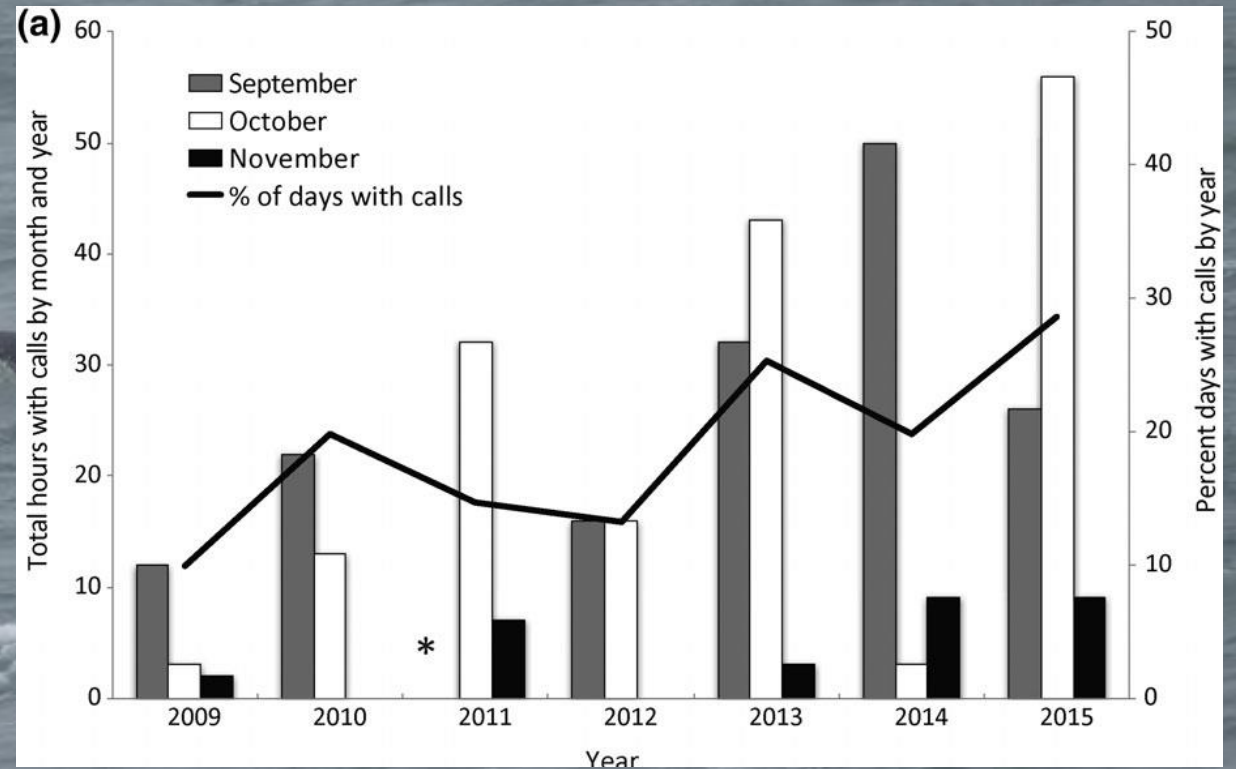
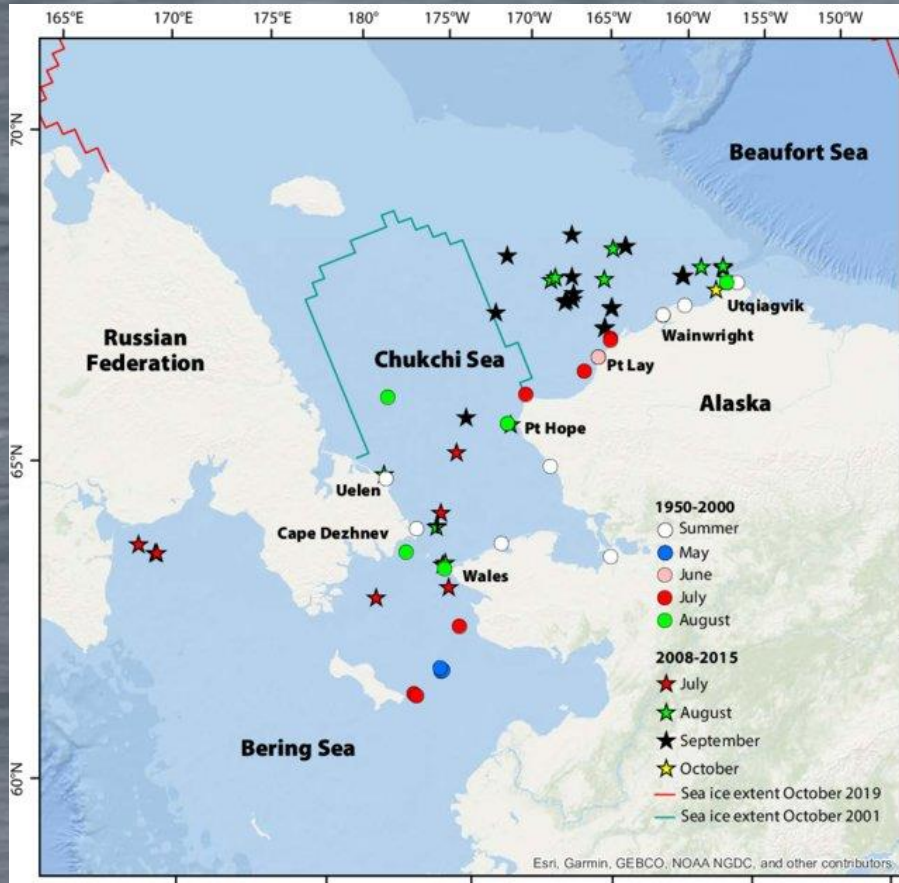
Volume 256, 1 March 2023, 104959



Shifts in bowhead whale distribution, behavior, and condition following rapid sea ice change in the Bering sea

John J. Citta^{a,1}, Greg A. Breed^b, Stephen R. Okkonen^c,
 Matthew L. Druckenmiller^d, Lori Quakenbush^a, John C. George^e, Billy Adams^e,
 Wieslaw Maslowski^f, Robert Osinski^g, Justin Olnes^a, Ellen V. Lea^h,
 Robert Suydam^{e,2}

Subarctic whales are moving north and staying there longer



- Recent studies by Brynn Kimber/Catherine Berchok (NOAA) and Hannah Sawyer (OSU) use acoustic data from the northern Chukchi and Beaufort Seas to show that killer whales are being seen and heard as far north as Chukchi Plateau and as far east as Prudhoe Bay, Alaska
- Increasing reports of killer whales nearshore hunting belugas, bowheads and even polar bears



JASA ARTICLE 

Marine mammal detections on the Chukchi Plateau 2009–2020^{a)}

Kathleen M. Stafford,^{1,b)}  Humfrey Melling,²  Sue E. Moore,³  Catherine L. Berchok,⁴ Eric K. Braen,⁵
Arial M. Brewer,⁵ and Brynn M. Kimber⁵

Humpback whale 3 Nov 2023



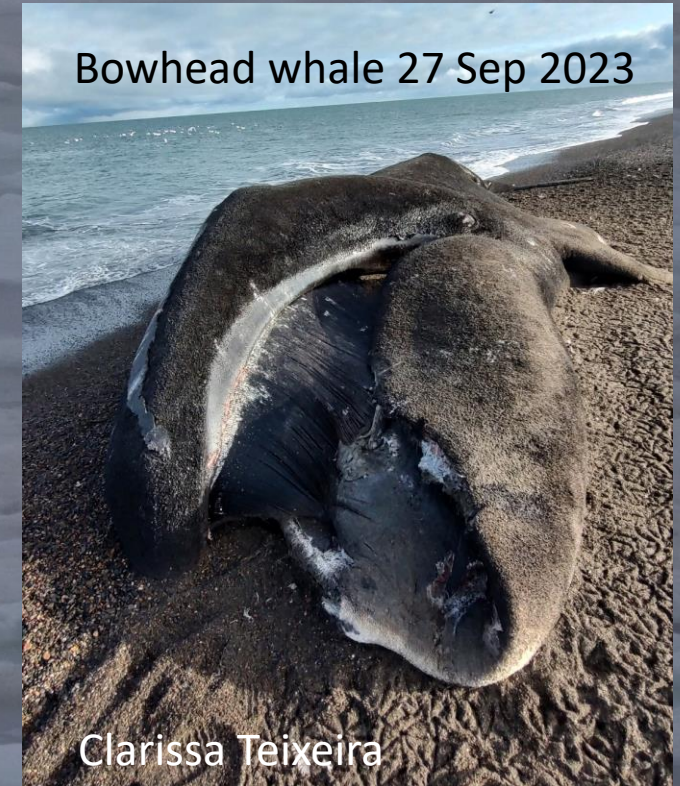
Qavvik Sarren

Qavvik Sarren



Fin whale 20 Nov 2022

Bowhead whale 27 Sep 2023

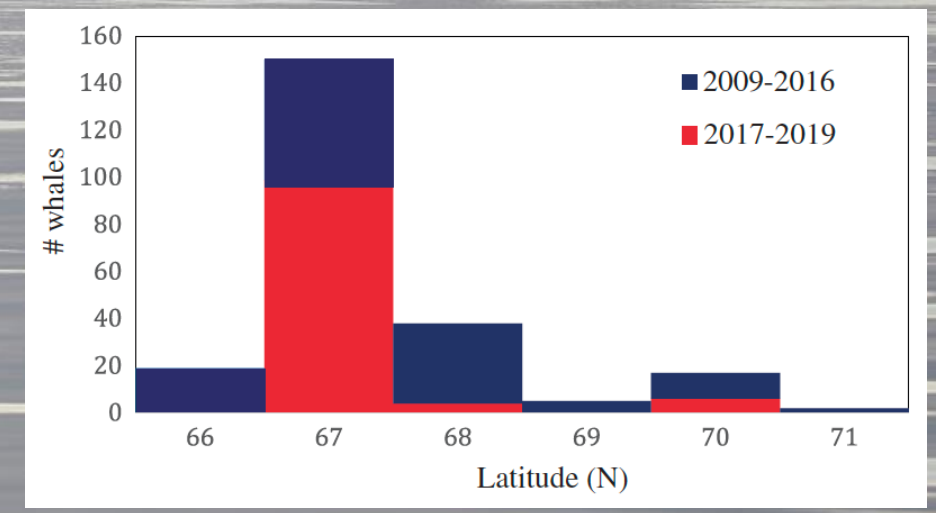
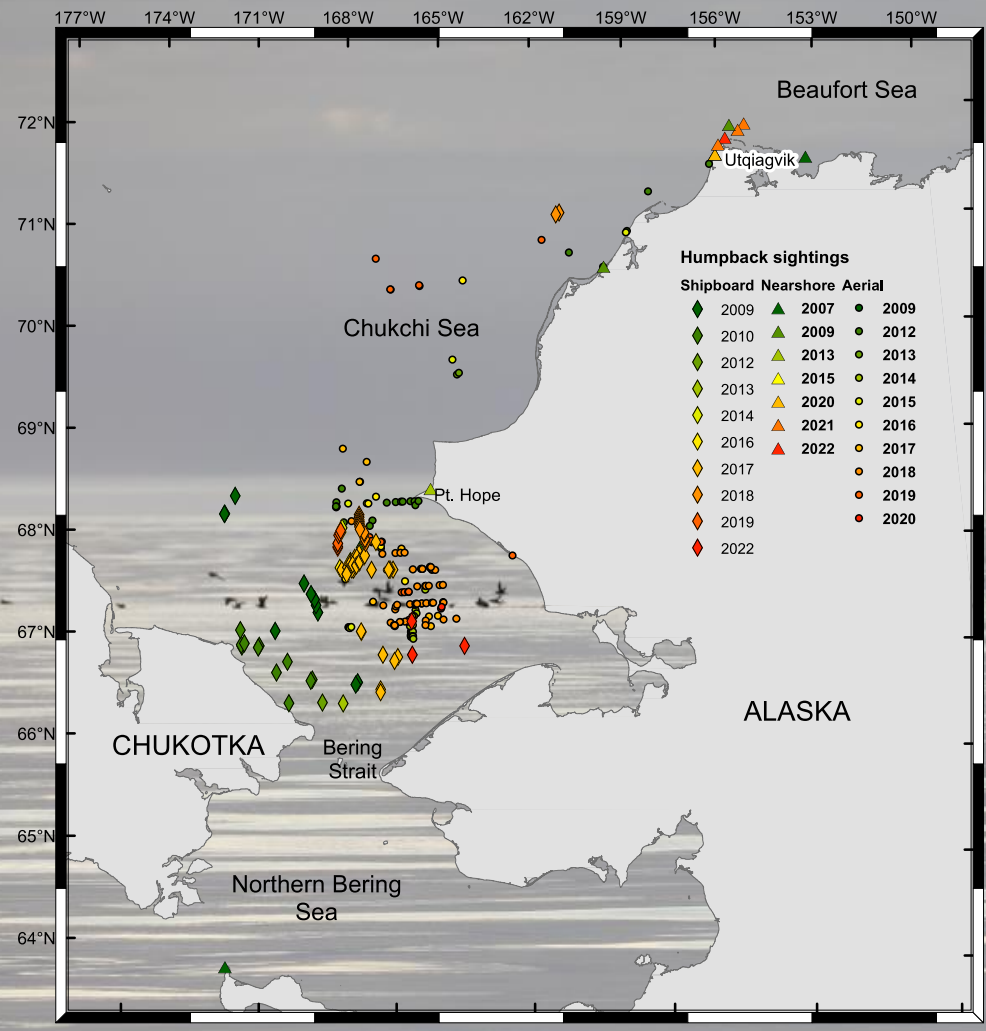


Clarissa Teixeira

NOTE

Humpback whale sightings in northern Arctic Alaska

Kathleen M. Stafford¹ | John C. George² |
Qaiyaan Harcharek² | Sue E. Moore³



BALEEN WHALES IN THE CROSS HAIRS: POTENTIAL FOR INCREASED SHIP STRIKE RISK IN AND NEAR BERING STRAIT

IUCN – SSC Cetacean Specialist Group / Arctic / Baleen whales in the cross hairs: potential for increased ship strike risk in and near Bering Strait

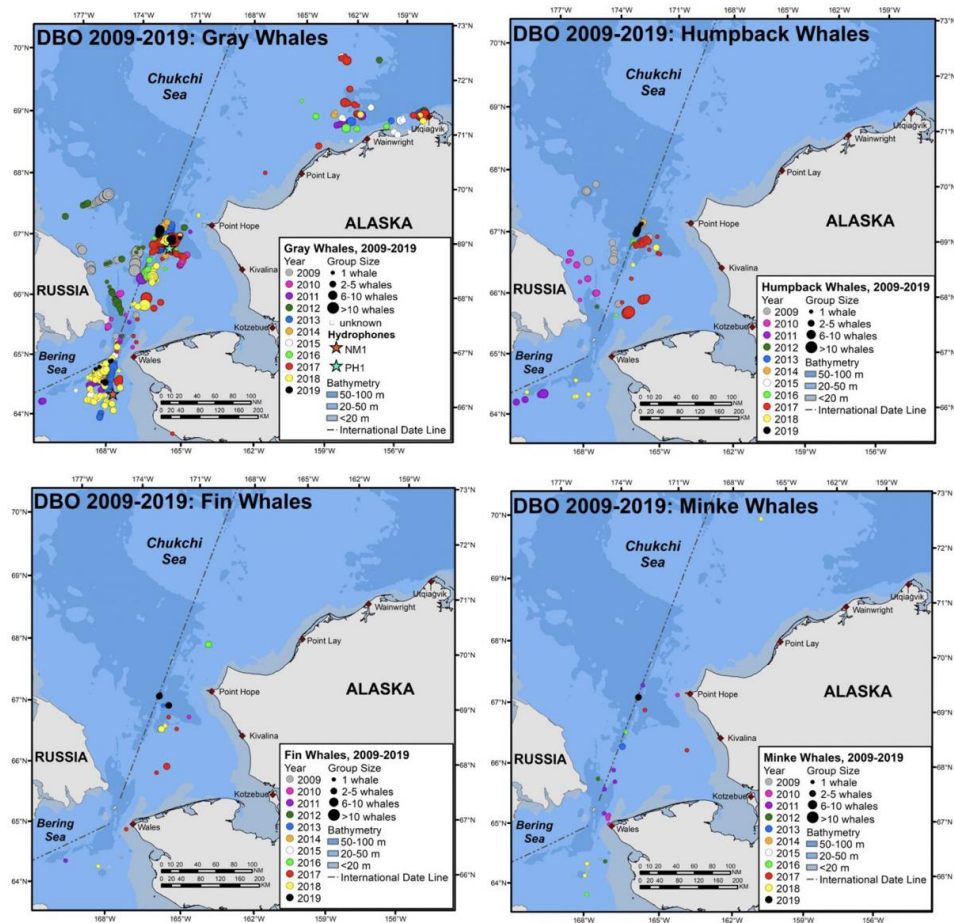


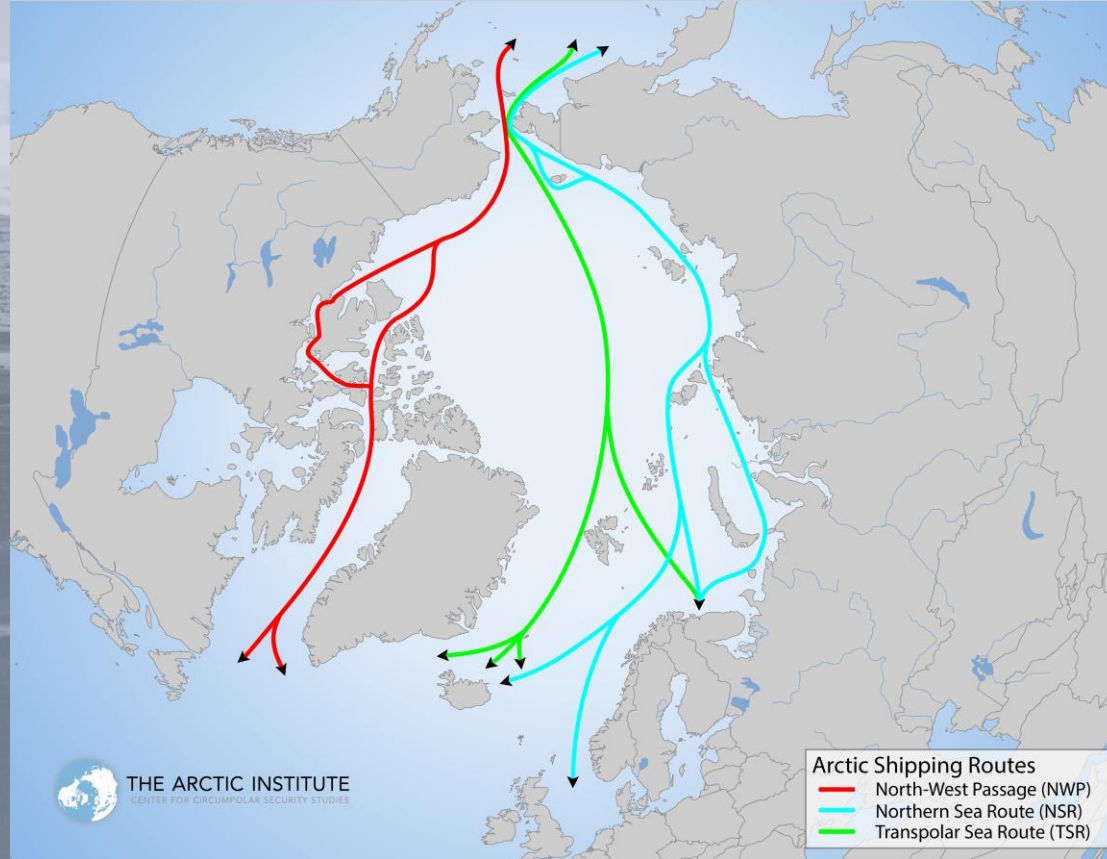
Figure 1 – Gray, Humpback, Fin and Minke whale sightings on DBO cruises, 2009-2019

DBO cruises with Marine Mammal Watch

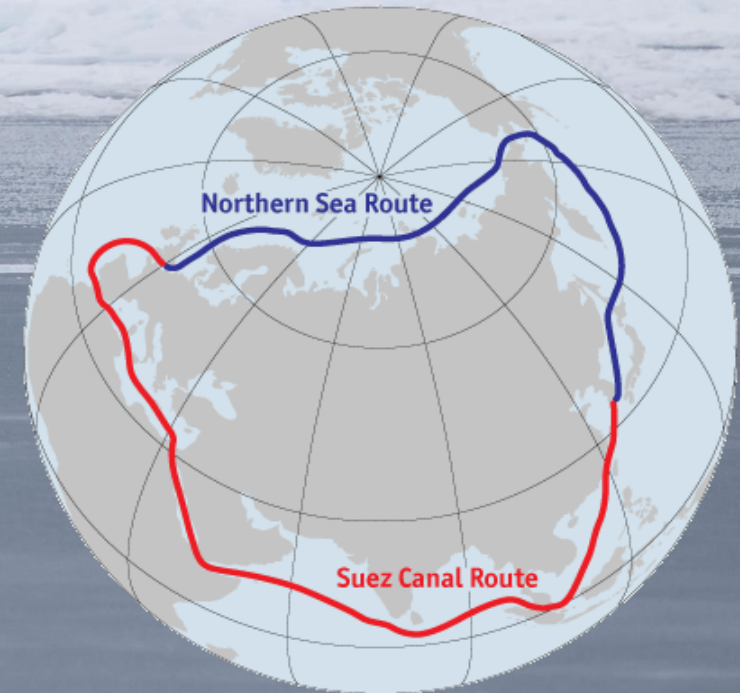
- 2022: >48 humpback and >13 fin whales
- 2023: >50 humpbacks and > 10 fin whales

<https://iucn-csg.org/baleen-whales-in-the-cross-hairs-potential-for-increased-ship-strike-risk-in-and-near-bering-strait/>

Human use of the Arctic is increasing

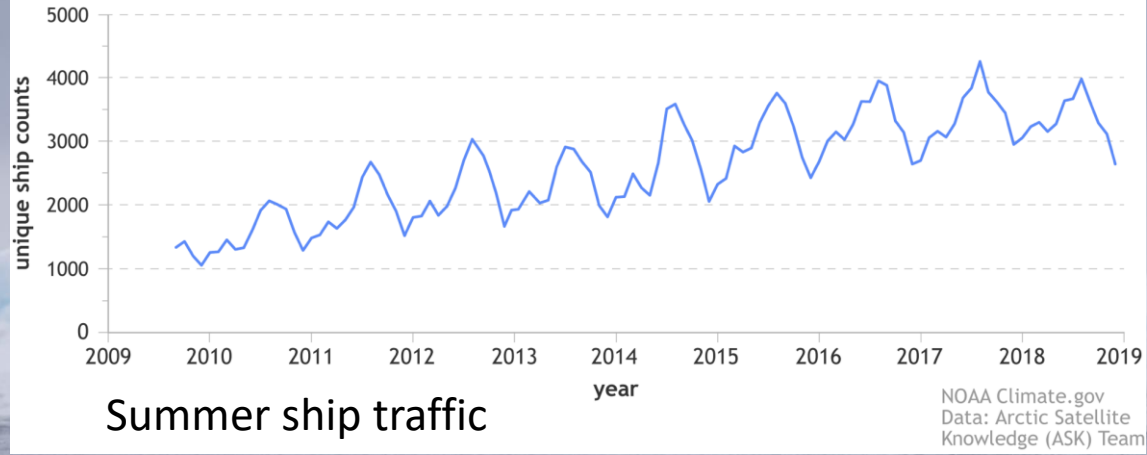


~50% distance savings
Northern Sea and Suez Canal routes



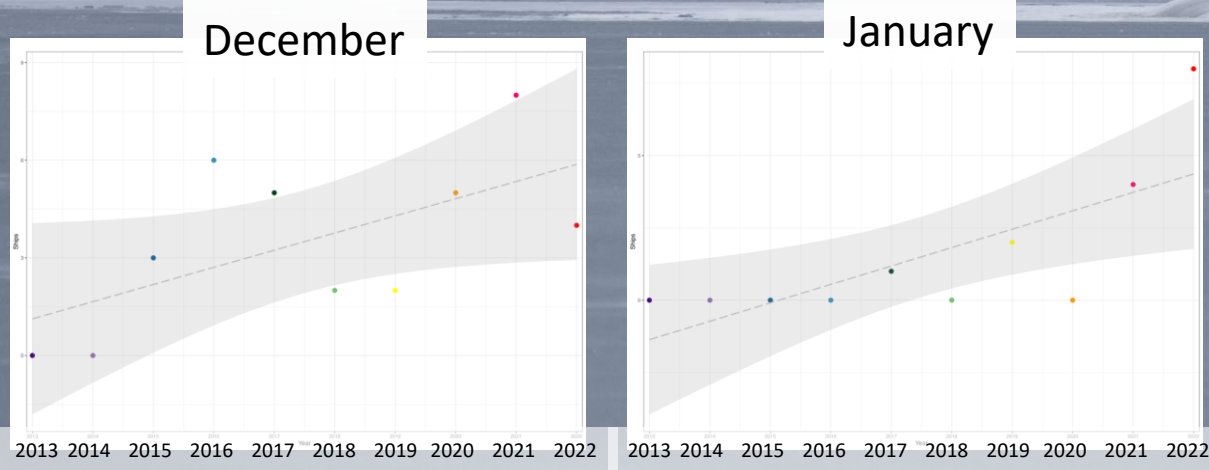
Arctic-wide ship activity has roughly doubled

Knowledge (ASK) Team

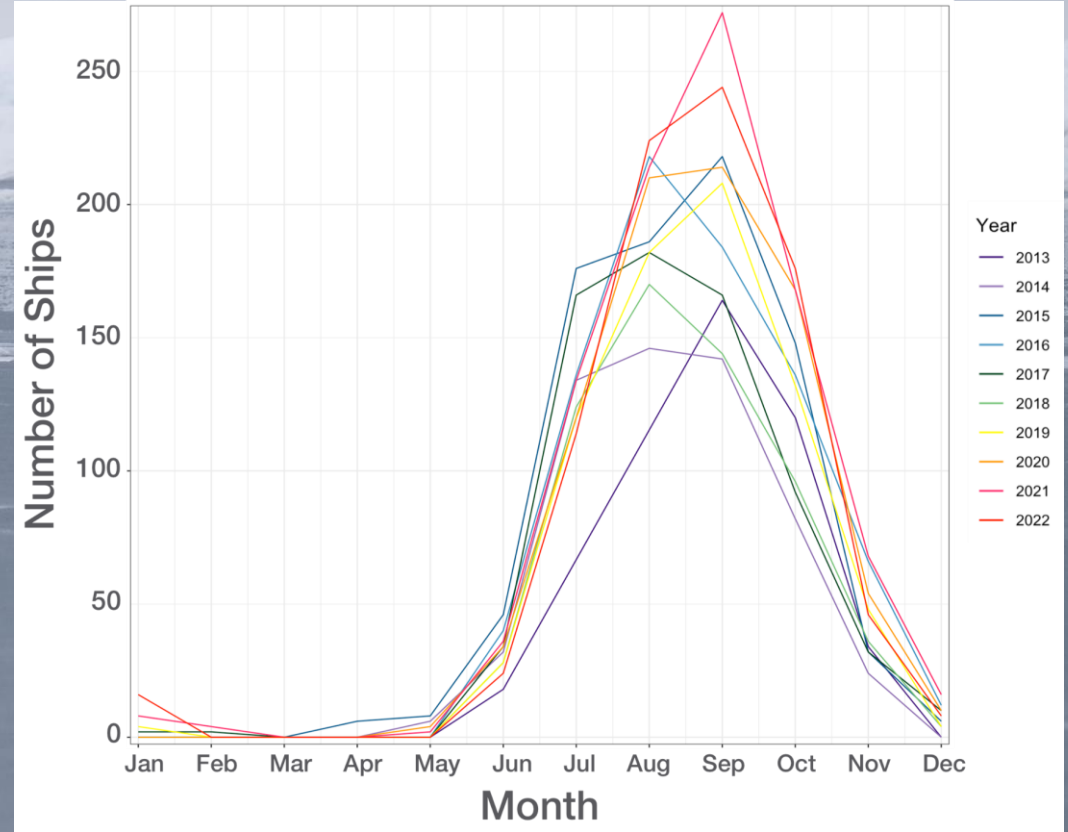


Ship traffic increasing through Bering Strait every year and every month – even in winter

Summer ship traffic



Winter ship traffic



Work done by Angela Szesciorka in collaboration with Greta Ferloni and Donna Hauser

The Pacific Arctic is changing rapidly from physics to upper trophic levels

ARTICLES

<https://doi.org/10.1038/s41558-020-0695-2>

nature
climate change

Check for updates

Evidence suggests potential transformation of the Pacific Arctic ecosystem is underway

Henry P. Huntington^{1✉}, Seth L. Danielson², Francis K. Wiese³, Matthew Baker⁴, Peter Boveng⁵, John J. Citta⁶, Alex De Robertis⁷, Danielle M. S. Dickson⁴, Ed Farley⁵, J. Craighead George⁸, Katrin Iken², David G. Kimmel⁵, Kathy Kuletz⁹, Carol Ladd¹⁰, Robert Levine¹¹, Lori Quakenbush¹², Phyllis Stabeno¹⁰, Kathleen M. Stafford¹¹, Dean Stockwell² and Chris Wilson¹³

Oceanography

THE OFFICIAL MAGAZINE OF
THE OCEANOGRAPHY SOCIETY

HOME

ABOUT

VIEW ISSUES

SUBSCRIBE

ORDER ISSUES

AUTHOR GUIDELINES

OPEN ACCESS

Northward Range Expansion of Subarctic Upper Trophic Level Animals into the Pacific Arctic Region

By Kathleen M. Stafford, Edward V. Farley, Megan Ferguson, Kathy J. Kuletz, and Robert Levine



